

**In-Service
Mercury Switch Review
July 11, 2003**

**Conducted by the:
Michigan Department of Environmental Quality
Environmental Science and Services Division
Pollution Prevention and Compliance Assistance Section**

In-Service Mercury Switch Review Outline

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I. Executive Summary

A legislative requirement in the Michigan Department of Environmental Quality's (MDEQ's) fiscal year (FY) 2003 budget appropriation directed the MDEQ to perform a review of in-service automotive mercury switch removal. To address this mandate, the MDEQ conducted a review of existing in-service removal programs, collected available information from automotive maintenance technical manuals, and interviewed government, interest groups and industry representatives. Given limited resources, this review did not include the collection of primary data, such as was gathered by the end-of-life field based study titled, "The Michigan Mercury Switch Study," December 19, 2002.

In conducting the in-service review, the MDEQ enlisted the assistance of a subset of people that had attended broad-based stakeholder meetings during development of the prior study. These people assisted the MDEQ by providing guidance, identifying and gathering sources of information, and commenting on the draft review. They are referred to as the "In-Service Review Group" (Appendix A).

The review examines two relatively large programs in New York and Oregon. To date, these programs combined are thought to have replaced somewhere between 5,000 – 6,000 mercury convenience lighting switches. These 'tilt' switches are located in assemblies found under the hood or deck lid (trunk) of vehicles and are used to control compartment lighting. Other smaller replacement programs have targeted mercury switches in government fleets or were conducted as short-term, one-time commemorative events. All of these programs replace the mercury pellet (switch) with an equivalent mercury-free, ball bearing pellet (switch). None of them replace the entire convenience lighting switch assembly.

The Michigan Mercury Switch Study looked at the removal of switches for end-of-life vehicles. The study found that nearly half of the vehicles examined contained a mercury switch. It also concluded that no comparable data could be found concerning switch replacement times for in-service programs. Most of the available information was derived from interviews that gave anecdotal information and rough approximations. To fill this void, the In-Service Review Group examined other available existing sources of information, such as labor and trade repair manuals, and also contacted three large Michigan-based automobile manufacturers to obtain related service and warranty information. All sources consulted indicated that it took between .2-.3 hours, or 12-18 minutes, to replace a mercury switch assembly (Appendix B). These estimates did not, however, break down the assembly replacement procedure into smaller segments for just pellet (switch) replacement.

The review concluded that in-service switch replacement could effectively complement a comprehensive mercury switch removal program. A

comprehensive program is one that includes end-of-life inspection and/or switch removal if necessary. In addition, any in-service component must include a system to permanently label vehicles where mercury switches have been replaced. This system should be universally recognizable and the In-Service Review Group advised that a national labeling standard be adopted.

A number of possible locations for voluntary in-service mercury switch-out replacement programs were examined, including fleet operations, full service repair shops, body shops, and car dealerships. Industry support, education, and incentives would all be essential if such a program were to succeed.

The review disclosed that some vehicles contain mercury switches that are difficult to replace without damaging the assembly beyond the point of re-use. Furthermore, as earlier noted, no existing in-service programs are known to replace the entire assembly, as it is suspected to be a costly undertaking. Estimates varied widely as to the percentage of vehicles having mercury switches that can easily be replaced (without having to change the entire convenience lighting assembly). Since no actual data exists, it can only be reported that every source contacted agreed that not all mercury switches (pellets) are replaceable.

Although mercury switches meet criteria for definition as hazardous waste, they are also eligible to be managed as universal waste. Comparatively speaking, universal waste requirements are less stringent and there are several advantages for managing it as such. Therefore, it is recommended that mercury switches be managed as universal waste and either recycled in a 'closed loop' system or stored and removed from commerce (provided that regulations allow it).

II. Introduction and Review Purpose (why in-service?)

Mercury released to the environment poses a major concern because it may deposit on land and water where it can accumulate in fish tissue, eventually making them unsafe to eat. As a result, the MDEQ has a long-standing goal to identify and reduce releases of anthropogenic (human derived) mercury to the environment. In this pursuit, the MDEQ has been actively partnering with stakeholders, such as the automotive industry, on mercury reduction initiatives since mid-1990. Today the use of mercury in the manufacture of new vehicles has been significantly reduced as the industry has stopped using mercury switches in vehicles as of the 2003 model year. Some other uses of mercury still remain, such as in HID headlamps and navigation screen displays; however, this review only addresses mercury switches used for convenience lighting purposes. Presently there remains a substantial number of mercury switches in vehicles on the road and in vehicles being scrapped at the end of their useful lives. If these mercury switches are not removed before vehicles become feedstock for new steel, mercury will be emitted into the environment.

In December 2002, the MDEQ released the Michigan Mercury Switch Study (MDEQ, December 2002) that investigated the removal of mercury convenience lighting switch assemblies in scrapped vehicles. The purpose of the study was to jointly conduct a cooperative project that evaluated the technical, logistical, and procedural factors associated with the removal of mercury (Hg) convenience light switches from end-of-life vehicles and subsequent management of the switches. It should be noted that the Michigan Mercury Switch Study identified 'in-service analysis' as an area deserving further investigation.

Concurrent to this process, language was inserted in the budget legislation for FY 2003 requiring the MDEQ to conduct a review looking specifically at mercury switch removal from in-service (other than end-of-life) vehicles. The language from the MDEQ's 2003 budget appropriation reads as follows:

**Budget Appropriation
Boiler Plate
Sec. 1003.**

"If the department participates, consults, or collaborates on a study regarding removal of automobile components in 2002, it shall review other removal options for similar components by September 30, 2003 including, but not limited to, removal from other than end-of-life vehicles."

To meet this legislative requirement, the MDEQ performed a review of current in-service removal programs, collected available information from automotive maintenance technical manuals, and interviewed government, interest groups, and industry representatives. This review did not include the collection of primary data such as was gathered by the end-of-life field based study cited above. The MDEQ enlisted assistance from individuals attending a broad-based stakeholders group that met during the prior study on end-of-life vehicles. A subset of those attending earlier meetings agreed to assist the MDEQ by providing guidance, identifying and gathering sources of information, and commenting on the draft report. They are referred to as the "In-Service Review Group" (Appendix A). This group participated in meetings and conference calls in order to provide input into the in-service review. Members were permitted to submit written comments on the final report prepared by MDEQ. Comments were submitted by one participant, the Automotive Recyclers of Michigan (Appendix J).

It should also be noted that this review does not address in length hazardous or universal waste regulations that pertain to mercury disposal or recycling. These areas have already been covered in the December 2002, Michigan Mercury Switch Study. URL links to additional information concerning this subject have been provided under the section covering Regulatory Considerations on page 14 of this review.

III. Existing Programs

As a first step in this review, other in-service removal programs operating in the United States were summarized. Aside from a few small isolated pilot projects or 'one time' events, two larger voluntary programs emerged. These programs are:

A. New York

The New York Department of Environmental Conservation (NYDEC) was an early pioneer in switch removal pilot programs. Initially, the NYDEC received a grant (\$50,000) from the U.S. Environmental Protection Agency's (USEPA's) Great Lakes National Program Office (GLNPO) to conduct a study on removing mercury-containing switches at auto salvage yards. This project later led to several additional voluntary initiatives for in-service removal and/or replacement of mercury switches. To date, approximately 12,000 switches from 30 yards have been removed. From this experience, the NYDEC fine-tuned and streamlined their switch recovery program.

The in-service switch-out program started with the purchase of nearly 2,000 ball bearing replacement switches (pellets) in 1999. These switches were supplied to the following facilities:

Buffalo Police Garage – 88 switches
CWM Chemical Services – 25 switches
Erie County Fleet – 72 switches
NYDEC Fleet – 220 switches
Public at State Fair – 22 switches
Saturn Used Car Dealership in Amherst – 80 switches
City Service Taxi of Buffalo – 20 switches

In 2000, the New York pilot program expanded to include in-service replacement at 30 different oil change and muffler shops. Fifteen hundred (1,500) ball bearing switches were distributed for replacement. Soon thereafter, it was discovered that between 60-80 percent of the convenience lighting assemblies had mercury switches that could not easily be replaced (Appendix E). As a result, program focus shifted to only the switches most easily replaceable, which include most Ford, GM, and one kind of Chrysler assembly. Other (most) Chrysler assemblies are molded plastic and cannot be opened to retrieve the pellet without damaging the assembly.

To date, the total number of switch-outs achieved has not been substantiated. The figures cited above reflect switches that were provided for replacement purposes. The labor to perform the switch replacements was provided by the participating auto service shops, while the ball bearing switches were purchased with EPA grant funds.

To supplement their switch recovery efforts, the NYDEC also developed a [Mercury Switch Replacement Poster \(PDF file\)](#) and [Mercury Switch Replacement Flyer \(PDF file\)](#) to promote public participation in replacing automotive lighting mercury switches with ball-bearing switches in on-the-road vehicles. The posters are displayed at service shops where the public can see them and make a request for the free installation of a ball-bearing pellet (switch).

The program at instant oil change and muffler shops proved unsuccessful according to NYDEC staff specialist, Mr. Tom Corbett. Mr. Corbett did not think that all the effort spent on in-service switch-outs resulted in capturing many switches. He thought the reason for this was that mechanics were not compensated for their involvement, and it was therefore difficult to get them to encourage public participation. It also became evident to him that the public did not want people tampering with their cars, unless 'they' themselves asked for the switch replacement service. (Telephone conversation with Mr. Corbett, March 3, 2003.)

Mr. Corbett did indicate that from his experience, there were plausible in-service opportunities for switch replacement in fleet vehicles. Programs for government/corporate fleets and at used car dealerships were successful. The reason for this success is believed to be linked to the commitment of upper management at these organizations. The mechanics doing the replacements were trained to do the work, but were also informed that the work was an important environmental mission for that company or agency.

B. Oregon


In Oregon, legislation was passed in May 2001 (House Bill 3007), calling for the establishment of a voluntary mercury auto switch replacement program. This law also prohibits the sale of cars that contain mercury (after 2006), and requires mercury switches be removed before cars are crushed for recycling.

In response to this mandate, the Northwest Automotive Trade Association (NATA) worked with the Oregon Department of Environmental Quality, Automobile Association of America (AAA), and the Oregon Environmental Council to develop a voluntary mercury switch replacement program.

Presently there are 95 repair and collision facilities participating in 26 communities throughout Oregon. Technicians typically remove two screws and one snap-on connector to dislodge the mercury pellet. This pellet is then replaced with a virtually identical (non-toxic) ball bearing

replacement switch. This service is provided at no charge to the customer and takes less than five minutes to complete (Appendix H). In 2003, it is reported that close to 3,000 mercury pellets have been successfully replaced (Appendix F).

Shops perform this service either during the car's routine maintenance or while servicing a vehicle for an unrelated problem. Then they store the mercury switches in containers that hold one pound of mercury, or approximately 300 (pellets) switches. Shops may use household hazardous waste events to dispose of the mercury or they can utilize private recycling services to pick up the mercury.

The switch replacement program is funded by a grant from the USEPA. Informal training/demonstration sessions were conducted throughout the state. Participating shops are then issued replacement ball bearing switches, mercury spill response instructions, storage containers, lists of vehicles with mercury switches, and diagrams indicating the location of the switches. All articles are provided to program participants free of charge. No-mercury  labels, (see page 11) similar to no-smoking signs, are also made available. These stickers are placed in door jams in order to signify that mercury switches have been removed.

Additionally, a brochure was developed to inform motorists about the impacts that mercury has on public health and the environment. Local business groups, vehicle emission testing centers, and retail centers have all served as distribution centers for the brochure. The NATA has also developed a special section on their website: <http://www.aboutnata.org> for consumers to learn how the program works and how they can locate participating shops.

The start-up cost for the Oregon program is reported to be approximately \$10,000; where switches (ball-bearing pellets) (\$4,000) and brochures (\$2,500) made up the largest percentage of the budget.

IV. Switch Removal Process/Disposal

A. Switch Removal Procedures

There are specific detailed downloadable, step-by-step, instructions available that describe mercury switch removal and replacement procedures. These are categorized by vehicle manufacturer and include color photos, drawings and illustrations. This information can be found at the USEPA's Region V Air website: <http://www.epa.gov/ARD-R5/mercury/autoswitch.htm>. Replacement techniques range in complexity from simply unclipping a plastic dome, removing the pellet, and sliding in a new ball-bearing switch (GM hood) to

dismantling and replacing the entire lighting assembly (many DaimlerChrysler models).

B. Switch Removal/Replacement Times

The December 2002 Michigan Mercury Switch Study reported that for end-of-life vehicles, the average removal time for the convenience light switch assembly and then pellet retrieval from the assembly was a total of 95 seconds. Review of existing in-service replacement programs, however, revealed little actual data. Most of the available information was derived from interviews that gave primarily anecdotal information and rough approximations. Given this lack of data, coupled with limited time and resources to do a field study, the In-Service Review Group agreed to pursue other existing available sources such as labor and trade repair manuals. The group also recommended that the MDEQ contact three Michigan-based automobile manufacturers for related service and warranty information. As a result, the following sources were consulted:

- Reynolds and Reynolds; Labor Time Guide
- Mitchell on Demand; on-line services
- Motors Crash Estimating Data (a Heart Business Publication)
- All Data; on-line
- MDEQ survey of three large auto manufacturers with offices in Michigan

All sources examined indicated a range of between .2-.3 hours, or 12-18 minutes, for switch assembly replacement (Appendix B). It should be noted that all estimates obtained were for 'complete' assembly replacement and not just pellet replacement. This is because the above sources did not break down the replacement times into any smaller segments other than assembly replacement. It is likely that instances involving just pellet replacement would take less time than the assembly replacement range(s) cited above.

Based on an analysis of switch removal data from the Michigan Mercury Switch Study, it was determined that 11 percent of the vehicles examined had both hood and trunk switches. For those situations, it should be assumed it would take longer than the above reported averages for switch replacement.

C. Vehicle Marking

The In-Service Review Group agreed that it would be important to mark vehicles as mercury switches are removed from under the hood and/or trunk. This is necessary so that other entities involved in the dismantling and recycling process can easily and clearly distinguish whether or not the mercury pellet(s) is present. This marking will save time and eliminate

unnecessary process redundancy. Many possible marking techniques are available and the group recommended that a uniform standardized national protocol be adopted. With an initial list provided by the Automotive Recyclers of Michigan (ARM), the In-Service Review Group listed and ranked many possible marking strategies. The ARM supplied list of options follows:

1. Have new (mercury-free replacement) switches made of green plastic with a recycled logo molded into them. Make all replacement switches the same “unmistakable” color so you can tell it has been changed.
2. Have sticker made to put over the new switch.
3. Have sticker placed by ID tag or tags on the driver door or trunk tag.
4. **Some sort of marking stamp or sticker to place on firewall, door pillar, and/or core support.**
5. Dye VIN Plate (perhaps a special spray paint).
6. **The use of a durable sticker for door pillar that will withstand the weather. Believe 3M makes one (similar to sticker, material-wise, that the Department of Natural Resources uses).**
7. **A silver (mercury color) round tag (possibly like furniture ID that hospitals and businesses use) should be put on door pillar that looks like Ø (meaning no mercury) with mercury symbol so when door is opened or replaced, the ID is still on pillar and easily identifiable.**

Based upon the In-Service Review Group’s resulting discussions, options that involved placing labels or stickers in the door pillar (**bolded options 4, 6, and 7**) received the highest ranking. With this in mind, and using information collected from prior vehicle labeling experiences, an auto company representative provided a detailed sample specification for such a sticker (Appendix I). It was further suggested that any labeling list the removed mercury-containing devices and to clarify those that which might remain. It was also recommended that if labels or stickers were printed, that they be purchased from a member of the Michigan Great Printers Project.

Other possible alternatives exist. For instance, a label similar to what the Oregon NATA Program uses, which is a door post label, shown below:
(Actual size is 1 1/4" round)



This label could, however, be somewhat misleading as other mercury-containing devices such as ABS brakes and HID headlamps may not have been removed from the vehicle.

To address this concern, the review group also collected other label samples for consideration, such as the Vermont/NE States RV Label shown here:
(Actual size is 1" X 6")

http://www.dec-o-art.com/rv/products_rv_sm7.htm

This vehicle may include mercury-containing devices installed by the manufacturer: Remove devices before vehicle disposal. Upon removal of devices, please reuse, recycle, or dispose as hazardous waste.	<input type="checkbox"/> High Intensity Discharge Headlamps	<input type="checkbox"/> Smoke alarms
	<input type="checkbox"/> Backlit Instruments	<input type="checkbox"/> <u>Other</u>
	<input type="checkbox"/> Automatic Leveling Jacks	<input type="checkbox"/> _____
	<input type="checkbox"/> T.V. Antenna Switch	<input type="checkbox"/> _____
	<input type="checkbox"/> Fluorescent Lamps in Appliances and Fixtures	<input type="checkbox"/> _____
	<input type="checkbox"/> Flame sensors in gas appliances such as hot water heaters & ovens	<input type="checkbox"/> _____

Finally, another possible labeling protocol to consider would be the New York Automotive Mercury Switch; **Green Dot** Mark labeling procedure (Appendix E).

D. Potential Sites for Removal/Replacement

There are a number of possible locations for in-service switch removal and replacement. These sites are listed below:

Dealerships	Service Garages	Body Shops	Instant Oil Changes
Used Car Dealers	Service Stations	Muffler Shops	Vehicle Fleets

Dealership replacement could be performed as a result of a direct factory recall (designed specifically to capture mercury switches) or at such time that vehicles are brought into the service department for unrelated automotive recalls or routine maintenance and repair. If needed, service bulletin(s) could be issued to alert dealership service departments to this concern.

Although the In-Service Review Group was unable to find any statistical reference to the possible percentage of owners that would respond to a general type of factory recall, they were able to locate statistics on the typical response rate to a 'safety' related recall. According to the National Highway Traffic Safety Administration (NHTSA) website: <http://www.nhtsa.dot.gov/nhtsa/announce/press/pressdisplay.cfm?year=2003&filename=pr06-03.html>, 72 percent of owners of vehicles with safety problems responded to notifications and actually had that recall work performed. It is probably then fair to assume that for a 'general type' of recall, one that does not involve either safety or engine performance, that the response rate could be significantly lower than the figure cited above.

When considering the potential for switch replacement during unrelated recalls, no data could be found. In other words, the percentage of on-the-road vehicles that typically ever experience a recall is unknown. Two review group members, however, thought it would be a pretty small figure. An additional element of uncertainty is the auto industries' lack of a reliable list showing specific years, makes and models of vehicles that contain mercury switches. The Michigan Mercury Switch Study found several contradictions occurring in the same year, make, and model. The reason was assumed to be due to assembly plants using different suppliers for convenience lighting switches. Some pellets supplied were mercury and some ball-bearing.

Used car dealers could offer vehicles for sale that have had their mercury switches removed or replaced. Other automotive service facilities, such as service garages, service stations, and body shops could also effectively partner in a switch replacement effort.

Further opportunities for mercury switch replacement may include switch-outs for vehicle fleets, such as state, county, local or municipal, corporate,

cab companies, car rental, fleet leasing, police agencies, and others. Occasionally, isolated or unique one-time (switch-out) events could commemorate special dates such as Earth Day or National Pollution Prevention Week, etc. These events help draw attention to the concerns surrounding mercury and the environment.

E. Potential Stakeholders for In-Service Program

The following entities may be involved and/or impacted by a voluntary mercury switch removal program in Michigan:

- AAA of Michigan
- Alliance of Automobile Manufacturers
- Automobile companies such as Ford, GM, and DaimlerChrysler
- Automotive Recyclers of Michigan
- Institute of Scrap Recycling Industries
- Local government, including household hazardous waste programs and those that operate fleets of vehicles
- Michigan Automotive Dealers Association
- Michigan Automotive Service Council
- Michigan auto shredders
- Michigan's Clean Sweep Program
- Michigan Department of Management and Budget
- Michigan's electric arc furnaces
- New and used car dealerships
- Non-governmental organizations, such as the Ecology Center, the National Wildlife Federation, Great Lake United, and Michigan Environmental Council
- Service Station Dealers Association
- Steel Recycling Institute

F. Issues for Consideration

i. Incentives

Certain incentives may be necessary to entice sponsor cooperation and to ensure adequate public participation in a voluntary program. Sponsors might receive financial incentives such as bounties or stipends, or in-kind support such as technical assistance, supplies, posters, brochures, switches, spill kits, stickers, or award recognition for program participation. Mechanics may also need some form of compensation or other incentive(s) to gain their cooperation. The public could be provided with some small token of appreciation for participating, like discounts on other products or services, letters, brochures, pins, or other incentives. Many of these options would require a combination of public and private financial support in order to be effective.

ii. Consumer Factors

During staff interviews with professionals who managed in-service switch programs, a recurring theme became clear. People are generally reluctant to have work performed on their vehicles when their vehicle is not broken and when they hadn't specifically come in for that purpose. As a result, it took considerable education to overcome the initial inertia and to generate candidates for switch replacement. Once educated, however, consumers may then become positive advocates and effective motivators in pressing for switch replacement. Therefore, such tools as marketing strategies and other incentives to educate consumers should be investigated. The most effective methods and best management practices should be incorporated into any in-service program.

iii. Regulatory Considerations

Mercury and mercury-containing devices are regarded as a hazardous waste and carry a variety of regulatory requirements. If an auto recycler chooses to manage mercury switches as hazardous waste, they will need to determine if this additional amount impacts their existing generator status. Go to the MDEQ web site at: www.michigan.gov/deq and select "Waste," "Hazardous Waste," and "Hazardous Waste Management" for links to these and other hazardous waste management regulations, rules, and requirements.

It is highly advised that any participant manage mercury devices as 'Universal Waste' since this process requires fewer regulatory provisions. In Michigan, universal wastes are regulated by the MDEQ, Waste and Hazardous Materials Division. Go to the MDEQ web site at: www.michigan.gov/deq and select "Waste," "Hazardous Waste," "Hazardous Waste Management," and under the Information heading select "Disposal of Hazardous Waste Types" to link to the MDEQ's universal waste publication. Managing hazardous waste as universal waste is advantageous; since total weight accumulated is not factored into the facility's hazardous waste generator status, manifesting is not necessary and the length of time that universal wastes can be stored on-site is more lenient.

It is envisioned that for any mercury switch removal program, the MDEQ would provide guidance and assistance regarding proper mercury management. For additional information on hazardous/universal waste management, contact the Waste and Hazardous Materials Division District Office or the Environmental Assistance Center at 800-662-9278.

iv. Spills

The Michigan Mercury Switch Study found that less than one percent of the pellets leaked any mercury during the pellet removal process. Therefore, the possibility of having a mercury spill during an in-service

replacement is also thought to be extremely remote. Still, it is always advisable that entities performing replacements should be equipped with mercury spill kits and be properly trained to respond in the unlikely event of an accident. The MDEQ could assist by providing step-by-step guidance for responding to small mercury spills. This information already exists, as does an extensive spill resource bibliography. This material is available on the MDEQ's Mercury Pollution Prevention (P2) website at: http://www.mi.gov/deq/0,1607,7-135-3585_4127_4175---,00.html.

v. Complexity of Procedure(s)

There are more than a dozen different mercury convenience lighting assemblies found in vehicles currently on the road. Some of these assemblies can be taken apart quickly and the mercury pellet replaced in just a couple minutes. Other assemblies require special cutting or power tools just to reach the mercury pellet. This disassembly process may also raise the likelihood of cutting into the mercury pellet, which, on rare occasions, could result in spilled mercury. After the mercury pellet is removed, many assemblies are then virtually impossible to reassemble for reuse. In some cases, they have to be held together by unconventional means, such as duct tape and zip ties. The life expectancy of this temporary fix is unknown. For these situations, replacement of the entire convenience lighting assembly is advisable, yet none of the existing replacement programs perform this service. Instead, they choose to only target the easier pellet replacement candidates.

The New York program estimated that 20-40 percent of all vehicles containing mercury convenience lighting assemblies have mercury switches that can be replaced (Appendix E). Other inquiries yielded varying estimations ranging up to 60 percent or higher in one other small replacement program. No actual data was available.

V. Conclusions and Observations

- In-service switch replacement could effectively complement a comprehensive mercury switch removal program that would also include end-of-life removal, provided that it included a system to permanently label vehicles where mercury switches have been replaced.
- To ensure that the highest percent of switches are removed prior to vehicles becoming feedstock for new steel, an end-of-life program is necessary to verify and/or remove mercury switches as necessary.
- Voluntary in-service replacement programs could be worthwhile in certain situations such as fleet operations, full service repair shops, body shops, and car dealerships. Industry support would be essential.

- In-Service switch replacement takes more time than removal at end-of-life, is more complex, requires better training, and cannot be accomplished in every case. The challenge of in-service versus end-of-life replacement is that the switches must be replaced and the assembly must then perform its intended function. Despite this, there are makes and models where the switch replacement process is relatively simple and makes sense to pursue.
- It takes somewhere between five (Oregon program) to eighteen minutes to replace a mercury convenience light switch or assembly from a vehicle. The time involved could increase if both hood and trunk switches are encountered. From the previous Michigan study, it can be assumed that two switches might be encountered in 11 percent of all vehicles.
- Some vehicles contain switches that are impossible to replace without damaging the assembly. Existing in-service programs do not replace entire assemblies as it is suspected to be a costly undertaking. The estimates vary widely from 20-60 percent or higher of vehicles with mercury switches that can be replaced without having to change the entire convenience lighting assembly. Since no actual definitive data exists, it can only be reported that every source contacted agreed, not all mercury switches (pellets) are replaceable.
- Successful in-service programs require 'buy-in' on the part of the particular industry sector performing the work. The entire process must be a high priority for the industry's management in order to ensure that mechanics and other staff cooperate.
- Vehicle owners may require persuasion and/or incentives to convince them to agree to a switch-out opportunity, as they may be concerned about modifications to their vehicles that are not related to safety and are not required by law. Educating vehicle owners can play a positive role toward overcoming this barrier and encouraging in-service replacement.
- In-service sponsors would need to experiment with various incentives in order for a program to achieve and sustain significant participation.
- Some form of labeling is essential to signify that mercury switches have been removed. It is advised that this label be affixed to the door pillar (frame) and that an easily recognizable uniform national standard be established. The label should also signify which mercury containing components have been removed.
- It is recommended that mercury switches be managed as universal waste and then either recycled in a 'closed loop' system or stored and removed from commerce (provided that regulations allow it).

VI. Citations

Michigan Mercury In-Service Switch Review

- 1). Michigan Mercury Switch Study, December 2002
<http://www.deq.state.mi.us/documents/deq-ess-p2-mercury-michiganswitchstudy.pdf>

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- 2). New York Mercury Switch Program

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- 3). Oregon Switch Replacement Program

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Additional publications supplied:

- Managing Mercury Switches
- Information for Vehicle Dismantlers and Crushers; Fact Sheet

VII. Appendices

Appendix A

The MDEQ conducted this review with the assistance of representatives from the following companies, groups, or associations. Members of the In-Service Review Group were:

Ms. Marcia Horan, Michigan Department of Environmental Quality
Mr. Steve Kratzer, Michigan Department of Environmental Quality
Ms. Joy Taylor-Morgan, Michigan Department of Environmental Quality
Mr. Cass Andary, Alliance of Automobile Manufacturers
Ms. Barbara Utter, Automotive Recyclers of Michigan
Mr. Ross Good, DaimlerChrysler
Mr. Jeff Gearhart, Ecology Center of Michigan
Mr. Ken Schram, Schram Auto Parts, Lansing

Appendix B

March 31, 2003, E-mail transmittal
from Ken Schram:
Schram Auto Parts-Lansing

Hi Steve

On the switch removal time I used a publication called Motors Crash Estimating Data (a Heart Business Publication). After searching over 40 vehicles I found that all switches (under hood lamps) it was unanimous 0.3 hours. So I think the info you got was right on the money. I will not be able to attend the conference call on Wednesday. Keep me posted.

Ken Schram
Schram Auto Parts-Lansing
1325 N Cedar
Mason, Mi 48854
517.694.2156

Appendix C

Survey on In-Service Switch Removal Process
Work Procedures/Time Standards
Conducted by:
Michigan Department of Environmental Quality
Environmental Science and Services Division
April 14, 2003

The following figures report on the time it takes to replace convenience light switch assemblies in hoods and trunks from automobiles. The times were obtained from three large auto companies with offices in Michigan during a telephone survey conducted by the chief of the Pollution Prevention and Compliance Assistance Section of the Michigan Department of Environmental Quality. The times were provided voluntarily:

- Auto company 1
.2 hour
- Auto company 2
.2 to .3 hours
- Auto company 3
.2 to .3 hours

NOTE: The times are per switch so that each switch takes between .2 or .3 hours (12-18 minutes). If there are two switches, both hood and trunk in the vehicle, it takes .4 - .6 hours (24-36 minutes).

Appendix D

MAR-19-2003 14:52 FROM: SHAHEEN PARTS 5172726564

TO: 93733675

P: 2/2



Mailing Address:
P.O. BOX 27247 • LANSING, MI 48909-7247
(517) 394-0330

March 19, 2003

Steve:

Here are the labor times you needed for the Mercury switches. All models are a B9660 and pay .2hr. for \$13.69.
If there is any thing else I can help with feel free to call me. (517) 272-6560.

Thank you,

Bob Denison
Bob Denison
Shaheen Chevrolet

*Trunk or deck lid
are even easier*

*The min. labor op
for GM
is .2*

*Yes it does
that's what
total job pays
the
That's what the
technician gets
paid.*

632 AMERICAN ROAD • LANSING, MI 48911 • FAX (517) 394-5279
COLLISION CENTER • WHOLESALE PARTS • FLEET OPERATIONS: 3901 S. MARTIN LUTHER KING BLVD. • LANSING, MI 48910
COLLISION CENTER FAX: (517) 394-7640 • PARTS FAX: (517) 394-6305 • FLEET OPERATIONS: (517) 393-1620

Appendix E

Automotive Mercury Switch; Green Dot Mark
New York Labeling Procedure

Marking Standard for Non-Mercury Automotive Hood and Trunk Lid Lighting Assemblies

Objective:

To enable the identification of automotive lighting assemblies that have had mercury switches replaced with non-mercury switches.

Why mark lighting assemblies?

The **green dot** mark will allow end-of-life processors of the vehicles to spot lighting assemblies that do not need to be removed from the vehicle. This will eliminate confusion about which vehicles have had mercury switches replaced by in-use programs designed to capture mercury before end-of-life processing.

Who will do the marking?

Anyone doing the work of replacing a mercury switch in an automotive hood or trunk lid lighting assembly, as part of an in-use replacement program, will be responsible for marking the re-assembled unit containing a non-toxic ball-bearing switch with the **green dot**.

Where will the mark be placed?

The **green dot** mark will be placed directly on the lighting assembly directly after the mercury switch has been replaced and will be positioned to allow ease of viewing when a vehicle trunk or hood lid is open. The placement of the **green dot** on trunk lid assemblies that are recessed in cavities to the right or left of the trunk lid latch will be on one of the two hex bolts that secures the lighting assembly to the trunk lid.

What will the standard mark look like?

The mark will be a **green dot** that will be between 1/8 and 3/8 of an inch in diameter and the color of green will be any shade of green lighter than Kelly green. The **green dot** will be painted on material (nail polish) and should have the qualities of good adherence and durability.

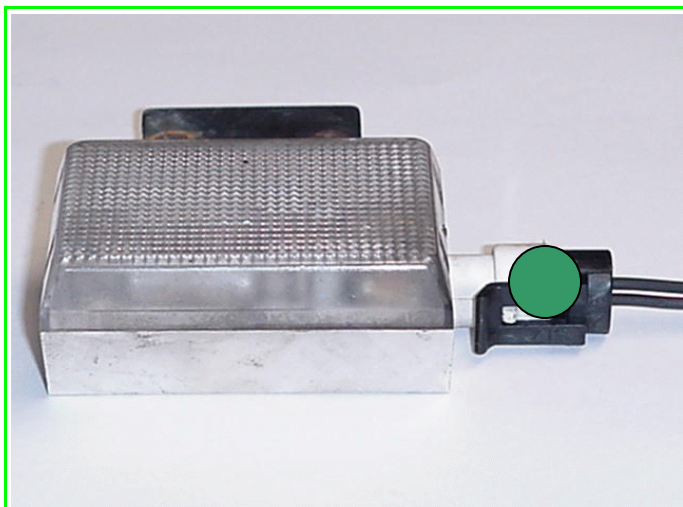
Examples:

The types of automotive lighting assemblies that are amenable to replacement are limited to a few types that are found in Chrysler, GM, and Ford vehicles. It is estimated that 20-40 percent of automotive lighting assemblies found in Chrysler, GM, and Ford vehicles (1950 – 2001; Chrysler ending in 1997) contain mercury switches that can be replaced without destroying the assembly. Some of the common types that can be replaced are included in the following examples:

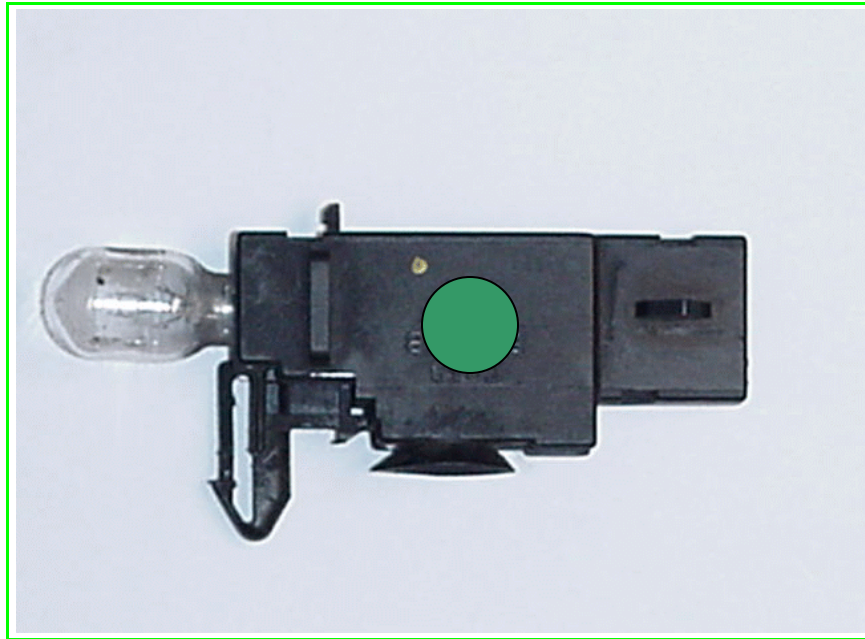
GM HOOD 1970 - 2001



GM HOOD 1980 - 2001 (Mostly Chevrolet Caprice and Lumina)



FORD HOOD & TRUNK 1960? - 2001



CHRYSLER HOOD 1980 - 1996



Appendix F

Oregon NATA Program Survey Results

Survey Questions	Dec 2001	Dec 2002
How many switches have been replaced? (Approximately)	316	2,735
Are the brochures a helpful tool when soliciting the program to your customers?	25 – Yes	76 – Yes
	8 – No	0 – No
What feedback have you received from your technicians about the replacement process?	22 – Easy	71 – Easy
	8 – Time Consuming	2 – Time Consuming
Do you use the list to identify cars containing mercury?	Yes – 20	25 – Yes
	No – 10	40 – No
How many new customers have brought their car to your shop to have their mercury switches replaced?	82	173
How many switches have you removed and not replaced with a ball bearing replacement? (Approximately)	2	0

Currently there are 95 shops participating in over 26 communities.

Appendix G

Oregon Program
E-mail transmittal
Delivered-To: jeffg@ecocenter.org
Subject: RE: Follow-up
Date: Tue, 11 Mar 2003 13:00:03 -0800
Thread-Topic: Follow-up
Thread-Index: AcLoESzHTh5MqWAqSNqrTCR846OKEg==
From: "Deb Elkins" <Deb@aboutnata.org>
To: "Jeff Gearhart" <jeffg@ecocenter.org>
Hello Jeff,

- 1) Training - Demonstrations were conducted and diagrams were distributed as to the location of the switches etc. during the "Kick Off" meetings around the state. These meetings were used to distribute education materials, replacement switches, storage containers etc.
- 2) Labeling – "No mercury" labels much like the "no smoking" signs were created and placed in door jams when switches were replaced.
- 3) Cost - \$10,000 - Switches (\$4,000) and Brochures (\$2,500) made up the largest percentage of the budget.

I have attached the following:

- Survey Results
- Info Sheet/Spill Program
- Summary of the Program
- Fact Sheet (for auto recyclers)

Good luck with your program!

Take Care,
Deb

Appendix H

Oregon Program Overview

The Northwest Automotive Trades Association (NATA) is a not-for-profit trade association serving more than 900 member businesses from all segments of the automotive industry. The NATA's office is located in Portland, Oregon, and is an affiliate of the Auto Recyclers Association, National Automotive Service Association (ASA), and the Society of Collision Repair Specialists (SCRS). The NATA is the automotive industry's business resource committed to promoting professionalism and education, providing quality benefits and services, representing common business interests, and building consumer confidence.

The NATA has developed a model mercury reduction program for auto repair, collision, and auto recycling facilities. Programs like Oregon's are feasible anywhere in the country.

Background

Mercury is a highly persistent toxic chemical that scientists and governments have targeted for elimination. Even in small quantities, mercury causes significant health and ecological problems, including learning disabilities in children. In Oregon, the Health Division issued fish consumption advisories for nine water bodies, including the entire mainstream of the Willamette River due to mercury contamination. Twelve major source categories for mercury discharge have been identified, including: hospital waste, fluorescent light bulbs, auto scrap and salvage yards, and others.

In the early 1990's the automotive industry recognized the concern over mercury and began a voluntary process to reduce the amount of mercury used in manufacturing motor vehicles. At that time, approximately 50 different applications containing mercury were used on an automobile, with mercury convenience light switches the first to be phased out. However, in 1995, convenience light switches remained responsible for 87 percent of the mercury use in automobiles.

Today, auto makers are still using mercury, despite the availability of practical and effective alternatives. The data on 2000 models indicates that auto makers have not produced a mercury-free vehicle as promised over a decade ago. In fact, automakers have increased mercury use in other applications, such as antilock brakes.

Action

In Oregon, with bipartisan support, legislation was passed in May 2001 that: 1) established a voluntary mercury auto switch replacement program; 2) prohibited

the sale of cars in Oregon after 2006 that contain mercury; and 3) required mercury auto switches be removed before cars are crushed.

Program

The NATA went to work developing a voluntary replacement program with the assistance of the MDEQ and the Oregon Environmental Council for auto repair and collision facilities.

Here's how the program works: facilities from all over the state that elect to participate in the program are provided with a list of vehicles that contain mercury in the hood and trunk lighting assembly. Technicians remove two screws and one snap-on connector to free the existing lighting assembly. The mercury ball bearing is then replaced with a non-toxic ball bearing switch that takes less than five minutes to replace. Hundreds of these switches have already been successfully replaced without incident or complaint of malfunction. Shops perform the "switch-out" at no charge to the customer.

Some shops perform the service during the car's regular maintenance or when servicing a vehicle for an unrelated problem. A grant through the USEPA made it possible to purchase the replacement switches at a reduced cost; therefore, participating shops are issued the ball bearing replacements free of charge.

In addition to the switch replacement, a brochure was developed for shops to inform motorists about the impact mercury has on the public's health and the environment. Local business groups, vehicle emission testing centers, and retail centers have served as distribution centers for the brochure.

Shops store the mercury switches in sealed containers provided free of charge by the NATA. The container holds one pound of mercury or 300 switches. Shops may use the household hazardous waste events to dispose of the mercury or they can have private recycling services pick up the mercury for less than \$15 per pound.

Ultimately, this program has given the NATA facilities the opportunity to take the lead in reducing the amount of mercury that reaches the scrap and salvage yards. And in the area of public relations, the NATA and its members continue to reap the rewards. From the number of speaking engagements to the radio and television coverage – participating shops are getting the recognition they deserve.

The NATA developed a special section on their website (<http://www.aboutnata.org>) for consumers to locate participating shops in Oregon. The section also describes how the mercury program works, as well as other contributions the NATA has made to the environment.

In Oregon, scrapped cars cause an estimated 260 pounds of mercury pollution each year, and one auto mercury switch contains one gram of mercury, roughly equivalent to the amount of mercury found in a household fever thermometer. Just one gram of mercury can contaminate a 20-acre lake so that the fish are unsafe to eat. In total, about 175 to 200 metric tons of mercury are in vehicles on the road today - across the nation. The bulk of mercury releases occur when scrapped autos contaminate steel that is then melted in electric arc furnaces (EAF). In Oregon, there are two such steel mills with EAFs – Cascade Steel in McMinnville and Oregon Steel in Portland.

In addition to the voluntary program for auto repair and collision facilities, the NATA has worked with the auto recycling segment of the industry to develop educational materials to help auto recyclers understand their legal responsibility, as well as their disposal options. The NATA has conducted informal workshops to educate auto recyclers, and a grant through a local solid waste company will accept up to 10 gallons of mercury at no charge to the auto recyclers.

Recommendation

The NATA believes there is sufficient evidence that auto switch replacement programs for auto repair and collision facilities, as well as mercury auto switch removal programs for auto recyclers, will actually reduce the amounts of mercury ending up in the nation's waterways.

We urge you to develop a mercury reduction program in your area.

Deb Elkins
Executive Director
Northwest Automotive Trades Association
1710 NE 82nd Avenue
Portland, OR 97220
Office (503) 253-9898
Fax (503) 253-9890
E-mail: Deb@aboutnata.org
Website: <http://www.aboutnata.org>
First Printing April 28th, 2002

Appendix I

(Sample) Label Construction Specifications

Source: Ross Good; DaimlerChrysler

Base Label Stock: The base label shall be any suitable film. The printed base film may be overlaid with a clear polyester (or other approved film) to achieve fluid resistance. Color and optical properties shall be such that, when printed with suitable inks, proper contrast is achieved. The base stock shall be free of defects which may detract from proper appearance or functionality.

Adhesive: The adhesive shall be uniformly applied to the backside of the base stock. It shall be of a uniform formulation that yields sufficient adhesion to last the life of the vehicle and retain satisfactory adhesion after exposure and aging.

Release Backing: The adhesive shall have a protective release backing that has sufficient strength to protect the adhesive film during shipment and handling. It shall not break or tear, and shall release evenly and cleanly during the process of removal from the adhesive film.

The release backing shall be free of silicone or any other surface treatment which, when transferred to the painted body surface, will cause adhesion problems.

Printing Inks: The inks used for printing shall be of a non-toxic formulation that resists smearing or smudging during normal handling and installation of the label. Color and optical properties shall be such that sufficient contrast with the base stock is achieved.

Recommended Label Suppliers:

Manufacturer	Label Material	Adhesive	Backing
Avery Dennison	170/P-9	51171	Vinyl Release Paper 007-L16
Whitlam Label	TWLC-42907	FA Adhesive	
	TWLC-42946	FA Adhesive	

Label Installation Instructions

1. Wipe surface clean with a clean damp rag to remove accumulated dirt and dust.
2. Wipe surface with an alcohol wipe to remove accumulated oils and greases.
3. Dry surface completely.
4. Remove backing and affix label to the clean dry surface.
5. Completely rub accumulated air bubbles from under the label surface and ensure that edges are completely sealed.
6. Properly dispose of alcohol wipe and label backing material.

Appendix J
In-Service Review Group Comments:

Letter received July 7, 2003
from the Automotive Recyclers of Michigan

**DATA IN THE MDEQ's 2003 IN-SERVICE REVIEW DOCUMENT SUPPORTS
A COMPREHENSIVE IN-SERVICE AND END-OF-LIFE REMOVAL PROGRAM
FOR AUTOMOTIVE MERCURY**

The Automotive Recyclers of Michigan (ARM), the trade association representing Michigan's automotive recycling industry, supports the Michigan Department of Environmental Quality (MDEQ) and the entire automotive industry in its efforts to remove automotive mercury. Accordingly, the ARM has a long history of voluntary participation in efforts such as the MDEQ's "Clean Sweep" mercury component removal program.

The ARM, however, respectfully disagrees with the conclusions and findings contained in the MDEQ's 2003 In-Service Switch Review document ("In-Service Review"). The underlying data leads to only one conclusion – that only a voluntary mercury switch program, which includes both in-service and end-of-life vehicles, and removal from all possible points in the automotive stream of commerce, will adequately protect the quality of Michigan's air and water. Conversely, any program which focuses solely on the role of recyclers in removing automotive mercury components to the exclusion of all other responsible parties will merely harm one industry to the detriment of our environment.

The ARM remains committed, however, to participating fully and enthusiastically in any voluntary program which: a) maximizes environmental protection through prevention, removal at all potential in-service and end-of-life sources; b) includes all mercury-containing components installed by manufacturers; c) has meaningful incentives for participation; and d) addresses liability and insurance issues associated with removal of mercury-containing components.

The following is a list of the ARM's specific responses to the conclusions and findings contained in the 2003 In-Service Switch Review document:

- The In-Service Review does not mention the findings of NHSTA that a comprehensive, voluntary in-service removal program has the potential to capture up to 2/3 of the mercury switches currently in the environment and that a comprehensive in-service and end-of-life program "...will actually reduce the amounts of mercury ending up in the nation's waterways." (quoting Oregon study).

- The In-Service Review greatly overstates the time differential between in-service and end-of-life removal, while understating the relative financial, regulatory, and liability burden on end-of-life removal by recyclers. In short, a successful program will require the “buy-in” of affected industries, whether the program is comprehensive or solely focused on end-of-life removal.
- No report to date examines the potential liability risks and increased labor and insurance costs for automotive recyclers arising out of participation in a voluntary removal program focusing solely on that industry.
- The In-Service Review does not address the relative liability and responsibility of various players in the automotive mercury stream of commerce. In short, automotive recyclers are not “generators” of automotive mercury because they have not placed this highly toxic substance into the stream of commerce. Moreover, the In-Service Review does not analyze the impact of the continuing installation of mercury in other components such as anti-lock brake systems.
- The In-Service Review reaches flawed conclusions on the feasibility of removal options based on original field research (December 2002 MDEQ study) for end-of-life removal by recyclers and anecdotal comments and a review of programs from other states in the case of in-service removal. The lack of original field research for in-service removal makes the time and barrier conclusions unreliable as a basis for designing a voluntary removal program.
- The In-Service Review does not consider the vast potential for collection presented by other points in which large numbers of end-of-life vehicles are aggregated, such as salvage pools serving auction houses and shredding facilities.
- The ARM did not participate in and does not endorse the results of the December 2002 MDEQ End-of-Life Removal Study, which focused solely on the role of recyclers.
- The conclusions regarding the time and relative ease of switch removal by recyclers in the 2002 End-of-Life Removal Study are highly suspect. A very high percentage of scrapped vehicles have seriously damaged front-ends, hoods, and trunks, which substantially increase the amount of time, labor, and expense for switch removal over and above that stated in the 2002 study. In contrast, in-service vehicles are generally undamaged, thus making removal much easier than in damaged end-of-life vehicles.
- The ARM supports a voluntary and comprehensive in-service and end-of-life removal program similar to that employed in Oregon. A comprehensive program has the best chance of maximizing the amount of removal in the

shortest period of time, thus yielding the most environmental benefits for the citizens of Michigan.

- If the state's public policy goal is to take all necessary steps to remove the maximum amount of mercury from the automotive chain of commerce and to prevent it from contaminating our precious air and water resources, then every industry must play a part in, and no industry should be singled out as the sole answer to, our state's automotive mercury problem. Automotive mercury eradication must include a halt to continued installation and removal from all possible in-service and end-of-life sources.